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# U.S. GRAIN MARKETING STRUCTURE IN THE 1970s

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## Introduction

Grain market structure can be defined as the organization of productive units in terms of the number and size of establishments. As a society we are interested in studying market structure because the structure influences market performance. Achieving satisfactory performance is an appropriate and frequently discussed goal for the grain sector of our economy. Since many different factors have affected the U.S. grain marketing structure in the 1970s, it becomes important to understand the current structure and how it may affect market performance. Previous research has clearly identified grain market structure and market performance for the 1960s and early 1970s prior to the first large grain sale to Russia and the other eastern European countries.[1/] The Southern Regional Grain Marketing Research Project S-115 entitled "Alternative Structures for Increasing Efficiency in Inter and Intra Regional Grain Marketing Systems", and the North Central Regional Research Project NC-137 entitled, "Alternative Rural Freight Transportation, Storage and Distribution Systems", have recently begun a study of the changes which occurred after 1970.

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1/ See, for example, Caves [1977-78], Copeland and Kramer [1973], Davis and Hill [1974], Fletcher [1964], Heid et al. [1965], Jones et al. [1975], Ladd and Lifferth [1975], Lytle and Hill [1973] and Phillips [1975].

The purpose of the regional research projects is to provide information and analysis which will lead to improved performance of the grain marketing system so as to better serve the needs of farmers, grain merchants and consumers (whether domestic or foreign). The specific objectives of this paper are: to describe and compare grain market structure among selected regions of the U.S. for 1977, and to identify major changes in the grain market structure of the Midwest and Southeast from 1970 to 1977. The states comprising each region will be presented in a later section of this paper.

Changes in grain and oilseed demand and supply and in grain marketing facilities during the 1970s are discussed in the next section of this paper. Grain market structure in selected regions of the U.S. for 1977 is presented in the following section. The fourth section analyzes the changes in grain market structure for the Midwest and Southeast from 1970 to 1977. The conclusions and implications are presented in the final section.

## Changes in Demand and Supply

An important factor affecting grain market structure has been the rapid growth in demand for grain and oilseeds during the 1970s. Even though export demand has been by far the most dynamic, domestic demand for these products has also increased during the 1970s. (See Table 1). Corn exports which were slightly less than 800 million bushels in 1971 increased by almost 2 billion bushels by 1980. Wheat exports increased 2½ times to over one and one half billion bushels while soybean exports have doubled since 1971. During this same time period domestic consumption of corn and soybeans increased almost 20 percent while domestic consumption of wheat remained about

Table 1

U.S. Production, Exports, Domestic Use and Prices of Corn, Wheat and Soybeans, 1971-1980

| Year | Production | | | Exports | | | Domestic Use | | | Season Average Price Received By Farmers | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Corn | Wheat | S Bean | Corn | Wheat | S Bean | Corn | Wheat | S Bean | Corn | Wheat | S Bean |
| | - - - - - - (000,000 Bu.) - - - - - - | | | | | | | | | - - - ($/Bu.) - - - | | |
| 1971 | 5641 | 1618 | 1176 | 796 | 632 | 417 | 4387 | 855 | 786 | 1.34 | 1.08 | 3.03 |
| 1972 | 5573 | 1545 | 1271 | 1258 | 1186 | 480 | 4733 | 785 | 803 | 1.76 | 1.57 | 4.37 |
| 1973 | 5647 | 1711 | 1547 | 1243 | 1217 | 540 | 4631 | 754 | 895 | 3.98 | 2.55 | 5.68 |
| 1974 | 4703 | 1782 | 1215 | 1149 | 1018 | 421 | 3677 | 672 | 780 | 4.09 | 3.02 | 6.64 |
| 1975 | 5831 | 2124 | 1547 | 1711 | 1173 | 555 | 4082 | 721 | 936 | 3.56 | 2.54 | 4.92 |
| 1976 | 6271 | 2145 | 1288 | 1684 | 950 | 564 | 4100 | 748 | 866 | 2.73 | 2.15 | 6.81 |
| 1977 | 6425 | 2038 | 1762 | 1948 | 1124 | 700 | 4260 | 850 | 1004 | 2.33 | 2.02 | 5.88 |
| 1978 | 7276 | 1778 | 1870 | 2133 | 1194 | 753 | 4943 | 837 | 1104 | 2.98 | 2.25 | 6.66 |
| 1979 | 7940 | 2136 | 2268 | 2433 | 1375 | 875 | 5214 | 782 | 1208 | 3.79 | 2.52 | 6.29 |
| 1980[a/] | 6649 | 2372 | 1817 | 2600 | 1525 | 800 | 5100 | 840 | 1180 | 3.86 | 2.71 | 6.71 |

[a/] Estimated as of February 1, 1981.

the same. Export demand increased rapidly because increasing per capita incomes in the industrialized nations enabled consumers to improve their diets by shifting from a relatively high cereal-low animal product diet to a lower cereal-higher animal product diet. This greatly increased the demand for grain and oilseeds in those countries. Governments of some of the centrally planned economies also decided to change their food policy in order to increase the proportion of meat in the diets of their people. Furthermore, modifications of U.S. export policy such as lifting the trade restrictions toward Russia and other Eastern European countries plus the devaluation of the U.S. dollar changed the entire world demand and price structure for grain and oilseeds in the early 1970s.

To further complicate this demand growth, the world crop of 1972 was extremely small in most countries except for the U.S. and Canada and this was followed by a bad crop in Russia in 1973. The rapid demand growth in combination with these bad crops, caused a rapid depletion of government and private stocks of grain and oilseeds in the U.S. as well as world stocks to precariously low levels. As expected, prices began to increase rapidly for U.S. producers of these products (See Table 1).

Before 1973, the U.S. government support price was higher than world prices making subsidies necessary to export grain to the international market. When Russia and many other countries, who had grain shortages in 1973, entered world grain markets, grain prices immediately increased above the U.S.

support price level and all inventories of the Commodity Credit Corporation (CCC) were completely depleted. Shortly after the CCC sold all its stocks, the CCC also sold most all of its grain storage facilities. These events and policy actions placed the United States grain economy under control of a free market - an event not seen since before 1933.

Even though farmers increased production to meet this increasing demand for export grain, demand was so strong that the increased production was continually kindled by higher grain prices. Farmers increased yields, brought more land into production and increased the proportion of grain being sold off-farm to meet this rapidly growing export demand. The result was that corn, wheat and soybean production increased by 33 percent, 40 percent and 70 percent, respectively, from the early 1970s to the end of the decade ( Table 1).

Changes in Grain Market Structure.

The enormous strain placed on a marketing system which was already operating under stress, was unparalleled in the history of U.S. grain economy. The structure of the U.S. grain market changed dramatically to meet this challenge. New export facilities were constructed at most of the major grain sea and lake ports. By 1976, the U.S. had 66 port grain elevators with a total storage capacity over 360 million bushels. Barge loading facilities were constructed along all rivers leading to the Gulf and also on the Columbia-Snake

River System. The growth of barge loading facilities increased rapidly to over 250 facilities with a combined capacity of 393 million bushels by 1976 and is estimated to be over 300 facilities at the present time. Rail rate changes which provided economic incentives to ship unit trains of grain to the East Coast and Gulf for export resulted in specialized inland grain facilities to service the growing export market. Only a few unit train loading facilities were in operation by 1970 and these were located in central Illinois. By 1976 the number of unit train loading facilities had increased to over 240 with a combined capacity of almost 478 million bushels and the number of facilities is now estimated to be almost 500.[2/] As the size of elevators increased to handle the large volumes needed for unit trains, the number of elevators, especially country elevators, continued to decrease during the 1970s.[3/] In this same period elevator storage capacity increased and farm storage capacity has more than doubled. In addition to these specialized grain facilities, the number of soybean processing plants had increased to 83 with a total daily processing capacity of 98,380 tons in 1976. Furthermore, the structure of farming changed dramatically as the number of farms declined at about a 1.1 percent annual rate during the 1970s while farm size increased to over 400 acres per farm by the

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[2/] Sharp [1978] defined a unit train as an integral movement of usually only one commodity from a single origin to a single destination, moving on a regularly scheduled train of 50 or more cars, avoiding all the terminal and switching operations, and utilizing both specialized loading and unloading facilities and specialized equipment assigned to dedicated service. Movement is governed by tariff provisions, requiring both controlled loading and unloading of the railroad equipment and a minimum annual tonnage

[3/] See Baldwin and Sharp [1976] and Larson [1975].

end of the decade. Farmers also became more specialized in grain and oilseed production in this same period.[4/]

Although the structure of the grain marketing and transportation system adjusted rapidly to meet this export challenge, the performance of this enormous task was not without problems. Transportation bottlenecks, both rail and barge, sometimes caused the flow of grain to come to a virtual halt. The shortage of storage capacity at the first assembly markets caused inconvenience to farmers during harvest and resulted in large quantities of grain being piled on the ground with little or no protection. Congestion at the ports caused by increased barge traffic many times resulted in extra demmurage charges. In spite of these and numerous other obstacles the job was performed but at some degree of inefficiency.

## U.S. Grain Market Structure in 1977

### Data and Procedure

Data for this paper were obtained from a 1970 and a 1977 grain facility survey which was begun by a cooperative effort of NC-137 and S-115 and later was expanded to include over 40 states in the U.S.[5/] Since data are not yet available from all states, this paper contains information from the following 16 states: Arizona, California, Connecticut, Georgia, Idaho,

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[4/] See Schertz [1979].

[5/] A grain facility or plant in this survey is one operating establishment or physical unit. In a firm which has more than one facility or plant each plant would be treated separately.

Indiana, Illinois, Kansas, Kentucky, Louisiana, Minnesota, Mississippi, Nebraska, North Carolina, Ohio and Tennessee.

These states are organized into the following regions to facilitate the discussion of grain market structure in 1977:

East North Central - Illinois, Indiana and Ohio

Southeast - Kentucky, Georgia, Louisiana, Mississippi, North Carolina and Tennessee

West - Arizona, California, Idaho, Kansas, Minnesota and Nebraska

In each state the total population of grain firms was obtained from lists such as those compiled by the licensing division of the state Departments of Agriculture. The facilities on this list were divided into groups based upon existing storage capacity and operational characteristics. The types of facilities or plants include country elevators, terminal and sub-terminal elevators, river elevators, export elevators, feed manufacturers, feed mills, flour millers, corn millers, soybean processors, distillers and others.[6/] Definitions for these types of facilities are presented in Appendix A. The regional committees recommended that each state interview all elevators with one million or more bushels of storage capacity and all river and export elevators. All soybean and corn processing facilities were also interviewed. All others were sampled on a Crop Reporting District (CRD) basis or some other basis determined by the cooperating state. After the regional

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6/ The other category included grain facilities that could not be classified into one of these groups.

committees developed a questionnaire with a selected minimum number of questions to be included in all surveys, each state had the opportunity to modify their respective questionnaire, to include additional questions, and was then asked to complete the interviews and tabulate the data. The cooperating states were asked to then send the grain flow information to the University of Illinois for analysis of national grain flows, and the market structure and transportation data was sent to The Ohio State University for analysis of U.S. grain market structure. The market structure data presented in this section must be considered preliminary at this time because not all the states have tabulated the data, and the data which has been received may still contain errors which need correction.

Number and Size of Plants

As can be seen in Table 2, the total number of plants in the 16 states equalled 7,601 in 1977. Among the regions, the East North Central, Southeast and West each had about 37 percent, 17 percent and 46 percent respectively of all plants. The most important types of plants were country elevators (65%), feed manufacturers (13%) and feed mills (10%). These 16 states had a total of 126 river elevators, 35 export elevators, 30 corn millers and 61 soybean processors. About 38 percent of the country elevators and over half the terminal and sub-terminal and river elevators were located in the three East North Central states of Illinois, Indiana and Ohio. The West had the most export elevators (17) followed by the Southeast. About 88 percent of all grain supplying firms (all types of elevators) were located in the East North Central and West regions.

Table 2: Number of Plants by Type of Plants, State, Region and Distribution within Region, 1977

| State and Region | Total Number of Plants | PLANT TYPE: Country Elev. | Terminal and Sub-Terminal Elev. | River Elev. | Export Elev. | Feed Manufacturer | Feed Mill | Flour Miller | Corn Miller | Soybean Processor | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | NUMBER OF PLANTS | | | | | | | | | |
| Illinois | 1229 | 873 | 145 | 67 | 4 | 84[a] | 0 | 9 | 15 | 14 | 18 |
| Indiana | 968 | 689 | 8 | 0 | 0 | 228[b] | 0 | 4 | 0 | 2 | 37 |
| Ohio | 623 | 357 | 5 | 4 | 4 | 11 | 165 | 1 | 2 | 4 | 70 |
| EAST NORTH CENTRAL | 2820 | 1919 | 158 | 71 | 8 | 323 | 165 | 14 | 17 | 20 | 125 |
| Percent Dist. | 100% | 68 | 5.6 | 2.5 | .3 | 11.5 | 5.9 | .5 | .6 | .7 | 4.4 |
| Kentucky | 50 | 8 | 0 | 6 | 0 | 9 | 19 | 2 | 0 | 1 | 5 |
| Georgia | 60 | 28[c] | 0 | 0 | 0 | 0 | 27 | 1 | 0 | 4 | 0 |
| Louisiana | 174 | 64 | 0 | 16 | 10 | 0 | 84 | 0 | 0 | 0 | 0 |
| Mississippi | 212 | 120[d] | 0 | 0 | 0 | 0 | 77 | 0 | 0 | 15 | 0 |
| N.Carolina | 607 | 235 | 0 | 4 | 0 | 325[e] | 0 | 39[f] | 0 | 4 | 0 |
| Tennessee | 206 | 92 | 4 | 5 | 0 | 69[g] | 0 | 24 | 7 | 5 | 0 |
| SOUTHEAST | 1309 | 547 | 4 | 31 | 10 | 403 | 207 | 66 | 7 | 29 | 5 |
| Percent Dist. | 100% | 41.8 | .3 | 2.4 | .8 | 30.8 | 15.8 | 5 | .5 | 2.2 | .4 |

Table 2 (continued)

| State and Region | Total Number of Plants | Country Elev. | Terminal and Sub-Terminal Elev. | River Elev. | Export Elev. | Feed Manu-facturer | Feed Mill | Flour Miller | Corn Miller | Soybean Processor | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | NUMBER OF PLANTS | | | | | |
| Arizona | 40 | 7 | 1 | 0 | 0 | 9 | 0 | 2 | 0 | 0 | 21 |
| California | 292 | 32 | 0 | 0 | 5 | 117 | 0 | 9 | 2 | 3 | 124 |
| Idaho | 117 | 115 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Kansas | 1054 | 985 | 34[h] | 4 | 0 | 5 | 0 | 18 | 4 | 4 | 0 |
| Minnesota | 1111 | 650 | 21 | 14 | 12 | 0 | 385 | 16 | 0 | 5 | 8 |
| Nebraska | 858 | 720 | 20 | 4 | 0 | 104 | 0 | 0 | 0 | 0 | 10 |
| WEST | 3472 | 2509 | 76 | 24 | 17 | 235 | 385 | 45 | 6 | 12 | 163 |
| Percent Dist. | 100% | 72.2 | 2.2 | .7 | .5 | 6.8 | 11.1 | 1.3 | .2 | .3 | 4.7 |
| TOTAL PLANTS | 7601 | 4975 | 238 | 126 | 35 | 961 | 757 | 125 | 30 | 61 | 293 |
| Percent of Plants | 100% | 65.4 | 3.1 | 1.7 | .5 | 12.6 | 10.0 | 1.6 | .4 | .8 | 3.9 |

[a] Includes feed manufacturer and feed mill.
[b] Includes feed manufacturer and feed mill.
[c] Includes all elevators.
[d] Includes country, terminal and river elevators.
[e] Includes feed manufacturer and feed mill.
[f] Includes flour miller and corn miller.
[g] Includes feed manufacturer and feed mill.
[h] Includes terminal and river elevators.

Over half the corn millers were also located in these three states. On the other hand, the Southeast had 43 percent of the feed manufacturers, nearly half of the soybean processors, over half of the flour millers and 30 percent of the feed mills; all of which indicate a relatively higher proportion of grain demanding firms in this region than in the East North Central and West regions.

The size distribution of these plants measured in terms of total permanent storage capacity in 1977 is shown in Table 3. Nearly 55 percent of the plants had less than 300,000 bushels of permanent storage capacity and another 20 percent had from 300,000 to 699,000 bushels of permanent storage capacity in 1977. Each of the next two size categories (700,000 to 1,099,000) and (1,100,000 to 2,999,000) had 10 percent of all plants. Four percent of the plants had more than 3 million bushels of total permanent storage capacity in 1977. The size distribution by regions indicates that the Southeast has a much higher percentage of small plants (less than 300,000 bushels) than either the East North Central or the West. Except for the higher percentage of large plants (more than 3,000,000 bushels of permanent storage capacity) and lower percentage of plants in the 300,000 to 699,000 category in the East North Central region, the size distribution in the West and the East North Central regions is quite similar.

When one uses the volume of grain received in 1977 as a measure of the size of plant, the distribution of plants is more unequal than when total permanent storage capacity is used (Table 4). Over 40 percent of the plants received less than 500,000 bushels of grain in 1977, however about 6 percent

Table 3. Distribution of Plants by Total Permanent Storage Capacity by Region, 1977

| Region | Permanent Storage Capacity in OOO Bu. 0 to 299 | 300 to 699 | 700 to 1099 | 1100 to 2999 | 3000 to 8999 | 9000 or More | Total |
|---|---|---|---|---|---|---|---|
| | - - - - - - - - - Percent - - - - - - - - - | | | | | | |
| East North Central | 51.3 | 19.9 | 11 | 11.8 | 5 | 1 | 100 |
| Southeast | 78.5 | 12 | 4.2 | 3.3 | 2 | 0 | 100 |
| West | 49.0 | 23.8 | 10.6 | 13.7 | 1.9 | 1.0 | 100 |
| Total | 54.9 | 20.3 | 9.7 | 11.2 | 3.1 | .8 | 100 |

Table 4. Distribution of Plants by Volume of Grain Received by Region, 1977

| Regions | Volume of Grain Received in OOO Bu. 0 to 499 | 500 to 999 | 1000 to 3999 | 4000 to 9999 | 10000 or More | Total |
|---|---|---|---|---|---|---|
| | - - - - - - - - Percent - - - - - - - - | | | | | |
| East North Central | 42.2 | 29.7 | 22.6 | 2.75 | 2.75 | 100 |
| Southeast | 67.5 | 13.7 | 14 | 2.8 | 2 | 100 |
| West[a/] | 32.9 | 19.1 | 30.9 | 7 | 10.1 | 100 |
| Total | 42.1 | 22.2 | 25.0 | 4.7 | 6.0 | 100 |

[a/] Data for Idaho not available.

received 10,000,000 or more bushels in 1977. The East North Central and the Southeast tend to have relatively more small plants while the West tends to have relatively more medium and large plants, especially plants which received 10,000,000 or more bushels in 1977.

In addition, the size of plant as measured by the volume received varies substantially among plant types (Table 5). Over 75 percent of the country elevators in the East North Central and Southeast received less than one million bushels of grain while in the West nearly 50 percent of the country elevators received more than one million bushels of grain in 1977. The feed manufacturers and feed mills, like the country elevators, also tend to be relatively small in size in the East North Central and Southeast regions. On the other hand, terminal and sub-terminal, river and export elevators received substantially larger volumes of grain than country elevators in all three regions. At least 75 percent of the export elevators in all three regions received 10 million or more bushels of grain in 1977. The distribution of river elevators by size category indicates that river elevators in the Southeast receive less grain than those in the East North Central or West. Flour millers tend to be quite widely distributed throughout all the size categories in the East North Central and West while in the Southeast 85 percent received less than 500,000 bushels of grain in 1977. Two-thirds of the corn millers in the East North Central region received 10 million or more bushels of grain in 1977 which contrasts sharply with

Table 5. Distribution of Plants by Type and Volume of Grain Received by Region, 1977

| Regions | Volume Received 000 Bu. | PLANT TYPE | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Country Elev. | Terminal and Sub-Terminal Elev. | River Elev. | Export Elev. | Feed Manufacturer | Feed Mill | Flour Miller | Corn Miller | Soybean Processor | Distiller | Other |
| | | - - - - - - - - - PERCENT - - - - - - - - - | | | | | | | | | | |
| East North Central | 0-499 | 32.4 | 3.7 | 0 | 0 | 75.9[a] | 94.4 | 14.4 | 8.3 | 5 | 0 | 75.7 |
| | 500-999 | 36.9 | 0 | 0 | 0 | 17.8 | .7 | 7.1 | 0 | 5 | 0 | 18.2 |
| | 1000-3000 | 28.7 | 29.6 | 9 | 0 | 6.3 | 4.9 | 50 | 25 | 0 | 0 | 6.1 |
| | 4000-9999 | 1.7 | 18.6 | 37.3 | 12.5 | 0 | 0 | 21.4 | 0 | 45 | 0 | 0 |
| | 10,000 or more | .3 | 48.1 | 53.7 | 87.5 | 0 | 0 | 7.1 | 66.7 | 45 | 0 | 0 |
| | TOTAL | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 0 | 100 |
| Southeast | 0-499 | 67.7[b] | 0 | 4.1 | 0 | 78.9[c] | 58.3[d] | 84.8[e] | 28.6 | 41.4 | 80 | 0 |
| | 500-999 | 16.3 | 9.1 | 12.5 | 0 | 12.7 | 16.2 | 1.5 | 28.6 | 0 | 0 | 0 |
| | 1000-3999 | 15.3 | 54.5 | 50 | 0 | 8 | 17.6 | 7.6 | 28.6 | 17.2 | 20 | 0 |
| | 4000-9999 | .7 | 27.3 | 16.7 | 20 | .4 | 5.9 | 6.1 | 0 | 17.2 | 0 | 0 |
| | 10,000 or more | 0 | 9.1 | 16.7 | 80 | 0 | 2 | 0 | 14.2 | 24.2 | 0 | 0 |
| | TOTAL | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 0 |
| West | 0-499 | 29.2 | 1.3 | 0 | 0 | 43.6 | 56.1 | 11.1 | 16.7 | 25 | 0 | 40.3 |
| | 500-999 | 20.9 | 5.1 | 4.2 | 5.9 | 21.8 | 13.3 | 11.1 | 16.7 | 0 | 0 | 18.5 |
| | 1000-3999 | 31.0 | 25.3 | 12.5 | 5.9 | 32.0 | 29.6 | 31.1 | 50.0 | 8.3 | 0 | 35.1 |
| | 4000-9999 | 6.7 | 39.2 | 29.2 | 11.7 | 2.6 | 1 | 37.8 | 16.6 | 0 | 0 | 15.5 |
| | 10,000 or more | 12.2 | 29.1 | 54.1 | 76.5 | 0 | 0 | 8.9 | 0 | 66.7 | 0 | .3 |
| | TOTAL | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 0 | 100 |

Table 5. cont'd

a/Data from Illinois and Indiana combined feed manufacturers and feed millers.

b/Data from Georgia combined all elevators. Data from Mississippi combined country, terminal and subterminal, and river elevators.

c/Data from Tennessee and N. Carolina combined feed manufacturers and feed mill.

d/Data from Georgia includes an integrated livestock firm.

e/North Carolina combined flour miller and corn miller.

f/Data from Kansas combined terminal and subterminal and river elevators.

the smaller size distribution of corn millers in the West and Southeast. All three regions have relatively more soybean processors in the 10 million bushels or more category than in any other size category.

The average turnover rate (total volume of grain received divided by permanent storage capacity) by size and type of firm is shown in Tables 6 and 7. As indicated by Table 6, average turnover rate declines as plant size measured in terms of permanent storage capacity increases. The turnover rate by region also differs markedly from 6.1 in the East North Central to 13.3 and 21.1 in the Southeast and West respectively. Among the various plant types, river and export elevators tend to have higher turnover rates than country or terminal and sub-terminal elevators (Table 7). Soybean processors tend to have the lowest turnover rates among all the plant types studied. The turnover rates for some plant types such as feed mills and feed manufacturers tend to vary widely from one region to another.

The volume of grain received by grain facilities by transportation mode is quite different among the three regions (Table 8). Rail transport is least important in the East North Central region and relatively unimportant in the Southeast. Even though rail transport is more important in the West, it is still small compared to total truck movements (farm truck plus other trucks). Truck movements were by a wide margin the most important transportation mode for grain

Table 6. Average Turnover Rate by Total Permanent Storage Capacity by Region, 1977[a/]

| Region | Permanent Storage Capacity (OOO Bu.) 0 to 299 | 300 to 699 | 700 to 1099 | 1100 to 2999 | 3000 to 8999 | 9000 or More | For All Sizes |
|---|---|---|---|---|---|---|---|
| East North Central | 9.75 | 2.80 | 2.70 | 2.69 | 2.20 | 1.42 | 6.15 |
| Southeast[b/] | 15.73 | 4.12 | 2.86 | 6.72 | 4.66 | - | 13.32 |
| West[c/] | 42.48 | 6.23 | 6.12 | 3.68 | 2.07 | 1.46 | 21.14 |

[a/] The turnover rate for each plant type is calculated by dividing its total volume of grain received by its permanent storage capacity. Each plant's turnover rate is expanded by its multiplier and then all turnover rates for each plant type is added. The sum of each plant type's expanded turnover rate is divided by the population for each plant type.

[b/] Kentucky is not included.

[c/] Idaho is not included.

Table 7. Average Turnover by Plant Type by Region, 1977

| Regions | PLANT TYPE | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Country Elev. | Terminal and Sub-Terminal Elev. | River Elev. | Export Elev. | Feed Manu-facturer | Feed Mill | Flour Miller | Corn Miller | Soybeen Processor | Dis-tiller | Total |
| East North Central | 4.31 | 4.28 | 43.10 | 4.45 | 7.32[a] | 7.72 | 2.90 | 17.41 | 3.61 | 0 | 9.75 |
| Southeast | 5.13[b] | 6.02 | 7.43 | 19.3 | 9.11[c] | 48.18[d] | 7.72[e] | 71.0 | 2.39 | 0 | 0 |
| West | 10.45 | 3.06 | 17.98 | 4.87 | 57.7 | 97.7 | 9.23 | 12.6 | 5.02 | 6.41 | 21.14 |

[a] Data from Illinois and Indiana combined feed manufacturers and feed mills.
[b] Data from Georgia combined all elevators. Data from Mississippi combined country, terminal and subterminal, and river elevators.
[c] Data from N. Carolina and Tennessee combined feed manufacturers and feed mills.
[d] Data from Georgia includes an integrated livestock firm.
[e] Data from N. Carolina combined flour miller and corn miller.
[f] Data from Kansas combined terminal and subterminal and river elevators.

Table 8. Volume of Grain Received by Non-Farm Firms by Mode of Transportation by Region, 1977

| Region | TRANSPORTATION MODE | | | Farm |
|---|---|---|---|---|
| | Rail | Truck | Water | Truck |
| | - - - - - (000 Bu.) - - - - - | | | |
| East North Central | 110,881 | 1,320,802 | 738,346 | 1,811,909 |
| Southeast | 405,918 | 10,562,645 | 33,417 | 2,196,014 |
| West | 685,772 | 529,553 | 0 | 1,537,957 |
| Total | 1,202,571 | 12,413,000 | 771,763 | 5,545,880 |

receipts at grain facilities in 1977. Grain receipts by water were only important in the East North Central region in 1977.

As indicated in Table 9, the volume of grain shipped under single car rail rates in 1977 was larger than that for any other rate category. Single car shipments are highly concentrated in the West and relatively less important in the Southeast and East North Central regions. The 2-5 car rail rates, important in all regions were relatively most important in the Southeast in 1977. Unit train shipments, the next most important rate category, were nearly all concentrated in the East North Central region. The 6-24 and 25-50 multi-car rates are about equally important in terms of total volume of grain shipped however, the former is larger in the East North Central region and the latter in the West.

Market Structure Changes 1970 to 1977

Data availability limits the discussion of grain market structure changes from 1970 to 1977 to only the Southeast and East North Central regions. This discussion is further restricted to the country elevator group because the most complete data is available for that plant type. It is quite evident from Table 10 that few country elevators in 1977 resemble the country elevator of 1970, especially in the East North Central region. Nearly three-fourths of all country elevators had less than 300,000 bushels of permanent storage capacity in 1970 compared to only 45 percent in that size category in 1977. Furthermore, the percent of all country elevators in the next three larger size categories increased

Table 9. Volume of Grain Shipped Under Selected Rate Types by Region, 1977

| Regions | R A I L R A T E S | | | | | | |
|---|---|---|---|---|---|---|---|
| | Single | 2-5 | 6-24 | 25-50 | Unit Train | Combination of Modes | Total Shipped |
| | - - - - - - - - OOO Bu. - - - - - - - - | | | | | | |
| East North Central | 54,933 | 213,884 | 52,422 | 10,379 | 279,076 | 0 | 610,694 |
| Southeast | 14,120 | 48,471 | 7,625 | 0 | 0 | 0 | 70,216 |
| West[a/] | 713,112 | 144,340 | 24,263 | 65,099 | 31,455 | 0 | 981,868 |
| Total | 782,165 | 406,695 | 84,310 | 75,478 | 310,531 | 0 | 1,662,778 |

[a/] Data for California and Kansas not available.

Table 10. Distribution of Country Elevators by Total Permanent Storage Capacity by Region, 1970 and 1977

| | | Permanent Storage Capacity in 000 Bu. | | | |
|---|---|---|---|---|---|
| | | 0 to 299 | 300 to 699 | 700 to 1099 | 1100 or more |
| | | - - - - - PERCENT - - - - - | | | |
| East North Central | 1970[a] | 72 | 16 | 8 | 3 |
| | 1977 | 44.6 | 22.9 | 13.1 | 19.4 |
| Southeast | 1970[a] | 67 | 19.3 | 5.7 | 7.5 |
| | 1977[b] | 70.9 | 19 | 6 | 4.1 |

[a] From Baldwin and Bateman [1977].

[b] Georgia's data combined all elevators and are being grouped as country elevators. Mississippi's data combined country, terminal and river elevators and are grouped as country elevators.

from 1970 to 1977 with the largest size category (1,100,000 bushels or more) showing the greatest increase in number of country elevators in the East North Central region. In contrast, the size distribution of country elevators in the Southeast changed very little from 1970 to 1977. The smallest size category of country elevators (less than 300,000 bushels) appears to have increased slightly while the next two size categories remain unchanged. The relative number of country elevators in the largest size category decreased by almost half from 1970 to 1977 in the Southeast.

## Conclusions and Implications

The U.S. grain market structure has changed dramatically to meet the challenges of the 1970s. The single most important factor causing this structural change appears to have been the rapid growth in export demand which changed grain market structure from one organized to serve primarily the domestic market to one organized to also serve a vast export market. Rapid increases in farm production which placed further strain on the grain markets also contributed to the structural change in grain markets during the 1970s. Transportation innovations such as unit train rates for grain created additional strong economic incentives for changes in grain market structure.

The most important changes in grain market structure during the 1970s are as follows: (1) Increased export capacity at

ports and barge loading facilities on inland waterways, (2) Greatly increased number of unit train loading facilities, (3) Increased storage capacity on farms and at elevators, (4) Increasing size of elevators and decrease in number of country elevators and (5) Larger farms more specialized in grain and oilseed production.

Grain market structure by region of the U.S. was quite different in 1977. Grain shipping facilities such as elevators were more prominent in the East North Central and West (88 percent of all elevator types were located in these two regions), while feed mills, feed manufacturers and other grain demanding firms represented a higher percentage of total plants in the Southeast. Nearly half (47%) of the total number of grain processors (flour, corn and soybean) were located in the Southeast.

Plants in the East North Central and West tend to have more total permanent storage capacity than plants in the Southeast. In the Southeast, almost 80 percent of the plants have less than 300,000 bushels of total permanent storage capacity compared to about 50 percent of the plants in the East North Central and West. These latter two regions have over 16 percent of their plants with total permanent storage capacity in excess of 1,100,000 bushels compared to five percent of the plants in the Southeast. Country elevators in the West tend to receive more grain than country elevators in the East North Central or Southeast.

Turnover rates tend to decrease as plant size increases in all three regions however, the turnover rates in the West (21.1) are much higher than the rates for plants in either the

Southeast (13.3) or East North Central (6.1). Among plant types, the processors tend to have lower turnover rates than elevators because of their need to have adequate supply for processing throughout the year.

When country elevator size is compared from 1970 to 1977 for the East North Central region, it is evident that rapid growth has occurred among elevators with more than 700,000 bushels of permanent storage capacity and that elevators with less than 300,000 bushels have greatly decreased in number.

Grain receipts by truck far exceeded receipts by rail or water in 1977. Single car grain shipments were more important than any other rate in 1977; however, unit train shipments were most important in the East North Central region which indicates the importance of the East Coast export market to the region.

# APPENDIX A

## Definitions of Firm Types Enumerated in 1977 NCSR Survey

Country Elevator: A plant whose primary activity is collecting and merchandising raw grain. A plant was classified as a country elevator if it received more than 50% of its raw grain directly from farmers and more than 50% of the raw grain received went out of the facility as raw grain. The definition is not affected by the destination of grain or whether some manufacturing of feed or ingredients takes place at the plant.

Terminal Elevator: A plant whose primary activity is collecting and merchandising raw grain. A plant was classified as a terminal elevator if it received more than 50% of its raw grain from firms other than farms and was shipping grain to multiple destinations. More than 50% of the raw grain received must move out of the facility as raw grain to be classified as a terminal elevator.

Export Elevator: A plant whose primary activity is the collection of grain from other plants, although it could be directly from farmers, and exporting it to countries outside the U.S. The plant must export more than 50% of all grain received to be classified in this category.

River Elevator: A plant whose primary activity is the collection of grain from other plants, although it could be

directly from farmers, and barging grain to export and domestic points. To be classified as a river elevator, the plant should barge more than 50% of all grain received.

Feed Manufacturer: A plant whose primary activity includes manufacturing a brand name of feed. To be classified as a feed manufacturing plant, more than 50% of its revenues must come from the sale of feed products.

Feed Mill: A plant whose primary activity is grinding grain into feed for farmers and the manufacturing of a brand name of feed is not a major economic activity. More than 50% of its revenue must come from grinding and sale of mixed feeds.

Soybean Processor: A plant whose primary activity is extracting oil and processing meal from soybeans as joint products of the operation. To be classified as a soybean processor, the plant must receive more than 50% of its revenue from processed products of soybeans.

Flour Mill: A plant whose primary activity is the milling of wheat flour(s) that result from complete milling of at least 50% of the wheat flour(s) received. The firm may also do blending of imported flour(s) but these cannot exceed the volume milled by the firm. This plant must earn at least 50% of its revenue from the sale of products produced from wheat.

Other: These are plants which merchandise grain but do not fit any of the above classifications. They are normally

small firms which are located relatively close to urban centers. To be classified as other, the plant is merchandising grain but is earning more than 50% of its revenue from the sale of products to non-farm customers.

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